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| APPLICATION NO. | FILING DATE | FIRST NAMED INVENTOR | ATTORNEY DOCKET NO. | CONFIRMATION NO. |
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| 09/679,023 | 10/04/2000 | Xiao-Bo Wang | 471842000200 | 5573 |

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| EXAMINER |
|---|
| BROWN, JENNINE M |

| ART UNIT | PAPER NUMBER |
|---|---|
| 1755 | |

DATE MAILED: 09/03/2003

Please find below and/or attached an Office communication concerning this application or proceeding.

| Office Action Summary | Application No. | Applicant(s) | |
|---|---|---|---|
| | 09/679,023 | WANG ET AL. | |
| | Examin r | Art Unit | |
| | Jennine M. Brown | 1755 | |

*-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --*

**Period for Reply**

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

**Status**

1)☐ Responsive to communication(s) filed on _____ .

2a)☒ This action is **FINAL**. 2b)☐ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

**Disposition of Claims**

4)☒ Claim(s) *25-41,44-48 and 65-78* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *25-41, 44-48, 65-78* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

**Application Papers**

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

11)☐ The proposed drawing correction filed on _____ is: a)☐ approved b)☐ disapproved by the Examiner.

If approved, corrected drawings are required in reply to this Office action.

12)☐ The oath or declaration is objected to by the Examiner.

**Priority under 35 U.S.C. §§ 119 and 120**

13)☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☒ None of:

1.☒ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____ .

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

14)☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).

a) ☐ The translation of the foreign language provisional application has been received.

15)☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

**Attachment(s)**

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO-1449) Paper No(s) _____ .
4) ☐ Interview Summary (PTO-413) Paper No(s). _____ .
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: .

## DETAILED ACTION

### *Claim Rejections - 35 USC § 112*

The following is a quotation of the second paragraph of 35 U.S.C. 112:

> The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

Claims 25 and 44 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

The current amendment to the claims adds the limitation "non-movably" to the piezoelectric transducer and electrode elements but Applicants fail to show specific support for this limitation in the text of the specification and contrary to Applicants suggestion, drawings do not aid in illustrating this limitation. Only electrodes are shown in the figures and it is known in the art that electrodes in microfluidic devices are stationary. Examiner requests removal of this limitation as it is redundant.

### *Claim Rejections - 35 USC § 103*

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

The factual inquiries set forth in *Graham* **v.** *John Deere Co.*, 383 U.S. 1, 148 USPQ 459 (1966), that are applied for establishing a background for determining obviousness under 35 U.S.C. 103(a) are summarized as follows:

1. Determining the scope and contents of the prior art.
2. Ascertaining the differences between the prior art and the claims at issue.
3. Resolving the level of ordinary skill in the pertinent art.
4. Considering objective evidence present in the application indicating obviousness or nonobviousness.

Claims 25-41, 44-48, 65-78 are rejected under 35 U.S.C. 103(a) as being unpatentable over Yasuda, et al. (US 6216538) in view of Becker, et al. (US 6294063).

Yasuda, et al. teach an electrophoretic and acoustic force apparatus for field flow fractionation with carrier medium (col. 3, l. 19-35; col. 7, l. 15-20; col. 9, l. 58-63; col. 12, l. 63). At least two electrode and at least two piezoelectric transducers are taught (acoustic - col. 5, l. 62 – col. 6, l. 2; col. 6, l. 43-49; col. 7, l. 26-29, 44-48; col. 11, l. 11-17; col. 15, l. 45-49; electric – col. 10, l. 33-34, 38-45; col. 11, l. 18-24; col. 12, l. 1-3; col. 15, l. 43-44). Phase of the wave can be varied as well as the amplitude which can create an inhomogeneous acoustic field (col. 6, l. 30-42). Yasuda, et al. teach that the acoustic wave generating elements can be switched back and forth to be either wave sending or wave receiving and each element can be individually controlled (col. 7, l. 57 – col. 8, l. 5; col. 8, l. 33-36). Example 1 teaches a method of sequential and or simultaneous use of both electrophoretic and acoustic fields. Yasuda, et al. do not specifically teach inlet and outlet ports or an array of electrodes. The example given in column 20, line 52 - column 21, line 4 illustrates a tube with electrodes and

piezoelectric transducers for acoustic manipulation of particle and a tube **inherently has an inlet and outlet** at each end because fluid flows through the tube. Also note that transducer are formed out of alternating electrodes and substrate, therefore the array of piezoelectric transducers could also be used for electrophoretic manipulation if a direct current were used rather than an alternating current therefore it also **inherently has an array of electrodes**.

Becker, et al. teach multiple inlet and outlet ports in an electrophoretic field flow fractionation apparatus as well as an array of electrodes (col. 4, l. 46 – col. 5, l. 3) for manipulation of sample (Figures 9, 9B, 11, 12, 13). Becker, et al. teach a chamber with at least one inlet port and at least one outlet port (col. 3, l. 26-28) with at least two electrode elements and preferably an electrode array disposed along a portion of the chamber energized by an electrical signal generator to create an electrical field to cause an electrophoretic force normal to the traveling direction of a carrier medium (col. 3, l. 49 – col. 4, l. 10, 35-40) whereby the chamber may be a tube (col. 28, l. 1-2). The AC or DC signal generator can be connected to a plurality of electrical conductor buses connected to more than two individual electrode elements (col. 7, l. 16-36; col. 20, l. 34-56). Alternately, electrode elements can be adapted longitudinally or latitudinally along the inside or outside of the chamber whereby the array may be parallel, interdigitated, castellated, polynomial or plane (col. 4, l. 1-40, 47-50). Electrode elements are made of metal layer(s) on the surface of the chamber, particularly gold and chromium (col. 7, l. 16-21; col. 20, l. 56-62). These elements create a spatially

inhomogeneous electric field (col. 5, l. 9-20) to vary the magnitude and frequency of the electrical signals (col. 4, l. 64 – col. 5, l. 8). Becker teaches introducing a medium into the apparatus (Example I, col. 16, l. 16 – col. 17, l. 51) and into the chamber giving a velocity profile and applying at least one electrical signal to provide an electrophoretic force on the medium normal to the traveling direction of the carrier medium and a second electrical signal used to generate an acoustic wave to displace matter normal to the direction of the carrier medium. Since the programmable manipulation force can be a dielectrophoretic force, electrophoretic force, an optical force or a mechanical force (ultrasonic force – col. 7, l. 63 – col. 8, l. 5) therefore it also inherently has the ability to move a packet by electrophoretic or ultrasonic movement depending on whether the force generator is DC or AC and the frequency of the AC as modulated by the controller for the force generator.

It would have been obvious to one of ordinary skill in the art to provide inlet and outlet ports so that the flow can go into one part of the device and out another part of the device as well as provide an array of electrodes so that electrical and acoustic fields may be generated and/or controlled simultaneously because Yasuda teaches both electrical fields for electrophoretic purposes as well as acoustic fields to focus separations in a capillary or flat surface and it would be easier to control both acoustic and electrical fields both individually and simultaneously so that sample position, separation and spatial relation and detection can be done easily and automated by computer.

***Response to Arguments***

Applicant's arguments with respect to claims 25-41, 44-48, 65-78 have been considered but are not persuasive.

1. Applicants specification, page 39, lines 16-24 admits that the electrode elements employed for generating an electric field corresponds to metal coated surfaces on top and bottom of the chamber and that DC electrical signals or low frequency AC signals will give off an electrophoretic force but can also be used as the electrode for energizing the piezoelectric transducer (page 39, lines 25-27; page 47, lines 17-30).

2. Yasuda, et al. teaches both electrophoretic movement of a sample as well as acoustic movement of a sample using transducers and electrodes. The Yasuda, et al. reference teaches a tube embodiment as described above, which inherently has a single inlet and a single outlet for the flow of solution therefore solution would be traveling through the device and have velocity and is not a fluidically closed system as alleged by Applicants. Secondly, Yasuda, et al. teach in Figure 10 two electrodes (33) and two piezoelectric transducers (31).

3. Becker, et al. cures the defects of Yasuda, et al. by providing multiple inlet and outlet ports as well as electrode arrays. Both are used to manipulate packets of particles using an array for movement, fusion and detection, both have computer control of the systems and both have individual control of each transducer and electrode for manipulation of individual packets and would be considered analogous art.

a) As described above, Becker states that both electrophoretic and mechanical

forces may be generated by the apparatus as illustrated in Figure 1 (col. 7, l. 63 – col. 8, l. 5). The passage cited by Applicants was one embodiment disclosed by Becker, et al. which uses the second electrode in a sensing capacity. This second embodiment does not constitute non-analogous art and does not destroy the primary reference. The apparatus is based on the use of electrodes and those electrodes can be used for application of electrophoretic forces, acoustic forces or can be used in conjunction with a feedback control loop to sense position of a packet in the chamber. All of these forms of electrode manipulation are performed using a force generator which is controlled by a computer and the fields used on the electrodes can be AC or DC and can be homogeneous or inhomogeneous. A low frequency electrical field generated will be an electrophoretic force while a high frequency electrical field generated will cause an acoustic force to be generated.

b) As for the inlets and outlets which Becker, et al. teach, it still does not destroy or teach away from that of Yasuda, et al. because Yasuda teaches electrophoretic forces used in a tube where acoustic forces are also used and a tube inherently has inlets and outlets therefore this does not modify the apparatus of Yasuda or teach away from it.

***Relevant Prior Art***

The prior art made of record and not relied upon is considered pertinent to applicant's disclosure.

WO 01/05513 A1 teaches that ultrasonic vibration and electrical field (dielectrophoresis) may be applied simultaneously and is further evidence that the art are analogous and inherent in the design of these devices using an array of electrodes.

US 4874507 teaches an apparatus for separating a mixture of particles having an equivalence of electrophoretic forces and acoustic forces.

US 4832814 teaches an electrofusion cell where electrodes are used to create electrophoretic or acoustic forces.

***Conclusion***

Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Jennine M. Brown whose telephone number is (703) 305-0435. The examiner can normally be reached on M-F 8:00 AM - 4:30 PM.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Mark Bell can be reached on (703) 308-3823. The fax phone number for the organization where this application or proceeding is assigned is (703) 872-9306.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is (703) 308-0661.

Mark L. Bell
Supervisory Patent Examiner
Technology Center 1700

jmb
August 19, 2003